



October 2011

**GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) AND ENHANCED
(DISSOLVED METALS) TREATMENT
AND
CONDITIONAL USE LEVEL DESIGNATION FOR OIL TREATMENT**

For

**Washington State Department of Transportation's
Compost-Amended Biofiltration Swale**

Ecology's Decision:

Based on Washington State Department of Transportation's (WSDOT) application submissions, including the Final Technical Evaluation Report (TER) dated September 2011, and recommendations by the Board of External Reviewers (BER), Ecology hereby issues the following use level designations for the WSDOT Compost-Amended Biofiltration Swale:

1. A General Use Level Designation for Basic (TSS) Treatment.
2. A General Use Level Designation for Enhanced (dissolved metals) Treatment.
3. A Conditional Use Level Designation for Oil Treatment.

Ecology's Conditions of Use:

Compost-Amended Biofiltration Swales shall be designed, installed, and maintained to comply with these conditions:

1. Each compost-amended biofiltration swale shall be designed as per Section 5-4.1.3 (RT.04 – Biofiltration Swale) of the WSDOT 2010 Highway Runoff Manual (HRM) with the addition of a 3-inch compost blanket.
2. The compost used for the 3-inch compost blanket will conform to WSDOT Standard Specification 9-14.4(8) for medium compost.
3. The compost-amended biofiltration swale shall be constructed as per RT.04 of the WSDOT 2010 HRM with the addition of a 3-inch compost blanket.
4. The compost-amended biofiltration swale shall be maintained per the maintenance standards for biofiltration swales in the WSDOT 2010 HRM.

5. Any post publication updates to the HRM must be followed and can be found at the WSDOT HRM website:

<http://www.wsdot.wa.gov/Environment/WaterQuality/Runoff/HighwayRunoffManual.htm>

6. WSDOT shall make readily available those documents that are deemed public information and make this information available upon request and in a timely manner.

7. The compost-amended biofiltration swale shall not be used in phosphorous-sensitive areas or phosphorous total maximum daily load (TMDL) areas.

8. Discharges from the compost-amended biofiltration swale shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: Washington State Department of Transportation (WSDOT)

Applicant's Address: Design Office
PO Box 47329
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Application Documents:

- Washington State Department of Ecology Application for Pilot Use Level Designation, WSDOT (June 2010)
- Quality Assurance Project Plan WSDOT Compost-Amended Biofiltration Swale, WSDOT (September 22, 2008)
- Draft Compost-Amended Biofiltration Swale Evaluation Technical Evaluation Report, Herrera Environmental Consultants (April 2011)
- Final Compost-Amended Biofiltration Swale Evaluation Technical Evaluation Report, Herrera Environmental Consultants (September 2011)
- Responses to BER comments, WSDOT and Herrera Environmental Consultants (September 2011)

Applicant's Use Level Request:

General Level Use Designation for Basic, Enhanced, and Oil Treatment.

Applicant's Performance Claims:

Field testing shows that the compost-amended biofiltration swale can remove suspended solids, dissolved metals, and oil from highway runoff and can meet Ecology's performance goals for basic, enhanced, and oil treatment.

Ecology's Recommendations:

Ecology finds that:

Compost-Amended Biofiltration Swales, when sized according to WSDOT RT.04 (with the addition of the 3-inch compost blanket (WSDOT Standard Specification 9-14.4(8) for coarse compost) is able to demonstrate, through laboratory and field-testing, the ability to achieve Ecology's basic (TSS) and enhanced (dissolved metals) performance goals.

Compost-Amended Biofiltration Swales, when sized according to WSDOT RT.04 (with the addition of the 3-inch compost blanket (WSDOT Standard Specification 9-14.4(8) for coarse compost) should be given the opportunity to demonstrate, through additional laboratory and field testing, if it can achieve Ecology's oil performance goals.

Findings of Fact:

1. Field-testing was conducted at a compost-amended biofiltration swale and a control (standard) biofiltration swale installed in WSDOT right-of-way in the median of SR 518 in SeaTac, Washington.
2. Continuous flow and rainfall data were collected over a 19-month period (March 2009 through September 2010). Water quality data was obtained from 23 storm events over a 13-month period (May 2009 through June 2010), resulting in a total of 15 grab samples and 16 composite samples from each swale (15 of which were paired events at both biofiltration swales).
3. The compost-amended biofiltration swale performed significantly better than the control biofiltration swale for removal of the following parameters: total suspended solids (TSS), dissolved and total zinc, dissolved and total copper, and total petroleum hydrocarbons (TPH).
4. A total of 15 valid TSS samples were collected at the compost-amended biofiltration swale: 8 samples were in the 20 to 99 mg/L influent TSS range and 7 samples were in the 100 to 200 mg/L influent TSS range. Since the sampled storm events were divided evenly between the two influent ranges, both performance goals were evaluated for the entire dataset. The upper 95 percent confidence limit for the mean effluent TSS concentration was 6.0 mg/L. The lower 95 percent confidence limit for the mean TSS percent removal was 91 percent. Both basic treatment performance goals were met with the required statistical confidence.
5. A total of 16 valid dissolved zinc samples were collected at the compost-amended biofiltration swale. The compost-amended biofiltration swale had significantly higher removal rates for dissolved zinc than all seven BMP types evaluated from the International Stormwater Best Management Practice database (ISBMPD), the control biofiltration swale, the WSDOT Ecology Embankment (Media Filter Drain), and the Filterra Bioretention System. The mean percent removal of dissolved zinc for the compost-amended biofiltration swale was 82 percent (range of 69 to 91 percent).

6. A total of 16 valid dissolved copper samples were collected at the compost-amended biofiltration swale. The compost-amended biofiltration swale had significantly higher removal rates for dissolved copper than two of the six BMP types (grass swales and sand filters) evaluated from the ISBMPD and the control biofiltration swale. No significant difference was found between dissolved copper removal in the compost-amended biofiltration swale and the other four BMP types in the ISBMPD (grass strips, filters with peat mixed with sand, retention ponds, and retention vaults). The mean removal of dissolved copper for the compost-amended biofiltration swale was 22 percent (range of -44 to 74 percent).
7. The dissolved copper removal for the compost-amended biofiltration swale was likely underestimated during this study due to low dissolved copper concentrations at the SR 518 site. If samples with influent concentrations less than 0.006 mg/L are removed from the dataset, the recalculated mean removal of dissolved copper for the compost-amended biofiltration swale was 38 percent.
8. The influent TPH concentration was less than 10 mg/L for 14 out of the 15 grab samples collected at the compost-amended biofiltration swale. The upper 95 percent confidence limit for the mean effluent TPH concentration was 0.69 mg/L and the lower 95 percent confidence limit for the mean TPH percent removal was 73 percent. Visible oil sheen was not observed in any of the effluent samples. Despite lower TPH influent concentrations than those specified in the oil treatment performance goal for TAPE, the data show that the compost-amended biofiltration swale is capable of providing substantial treatment for TPH concentrations (mean percent removal = 81 percent) found in typical highway runoff.
9. There was no significant relationship between aliquot-weighted average flow rate and TSS removal, dissolved zinc removal, TPH removal, or effluent TPH concentration; demonstrating that the measured pollutant removal performance can be applied to the range of flow rates monitored during this study (0.010 to 0.078 cfs).
10. There was a significant positive relationship between the aliquot-weighted average flow rate and effluent TSS concentrations; however, the maximum TSS effluent concentration measured at the compost-amended biofiltration swale was below the 20 mg/L effluent goal at and above the design flow rate (0.03 cfs).
11. There was a significant negative relationship between the aliquot-weighted average flow rate and dissolved copper removal; however, dissolved copper percent removal is strongly related to the influent dissolved copper concentration. As the flow rate increases, the influent dissolved copper concentration decreases (i.e., becomes more dilute at higher flow rates). When influent dissolved copper concentrations less than 0.006 mg/L are removed from the dataset, the relationship is no longer significant.
12. The compost-amended biofiltration swale generally exported total phosphorus (TP) whereas the control biofiltration swale did not. Both the compost-amended biofiltration swale and control biofiltration swale exported soluble reactive phosphorus (SRP).

Remaining Issues or Concerns about the Compost-Amended Biofiltration Swale:

1. Maintenance and replacement. How do pollutant removal efficiency and hydraulic capacity decrease over time, and at what point is maintenance or replacement required?
2. If possible, WSDOT should test a different compost-amended biofiltration swale facility in the future. Select the location to verify slope or soil-related siting limitations. The testing should attempt to carefully monitor the water balance.
3. WSDOT should test a compost-amended biofiltration swale facility at a location of higher TPH influent concentration, such as petroleum storage and transfer facility or an area of parking/storage/maintenance of heavy vehicles and equipment.

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Applicant's Website: <http://www.wsdot.wa.gov/Environment/waterquality>

Highway Runoff Manual Website:
<http://www.wsdot.wa.gov/Environment/WaterQuality/Runoff/HighwayRunoffManual.htm>

Ecology web link: <http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html>

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